Mini-Lecture 7.1
Radicals and Radical Functions

Learning Objectives:

1. Find square roots.
2. Approximate roots.
3. Find cube roots.
4. Find n th roots.
5. Find $\sqrt[n]{a^n}$ when a is any real number.
6. Graph square and cube root functions.
7. Key vocabulary: *principal square root, negative square root, index, n th root.*

Examples:

1. Find each square root. Assume that all variables represent non-negative real numbers.

   a) $\sqrt{25}$ b) $\sqrt{\dfrac{1}{9}}$ c) $\sqrt{0.04}$ d) $-\sqrt{49}$

   e) $\sqrt{x^2}$ f) $\sqrt{4x^4}$ g) $\sqrt{16x^{10}}$ h) $-\sqrt{100x^{36}}$

2. Approximate each square root to three decimal places.

   a) $\sqrt{11}$ b) $\sqrt{37}$ c) $\sqrt{113}$ d) $\sqrt{205}$

3. Find cube root. Assume that all variables represent non-negative real numbers

   a) $\sqrt[3]{8}$ b) $\sqrt[3]{\dfrac{1}{64}}$ c) $\sqrt[3]{x^6}$ d) $\sqrt[3]{-64x^9 y^{12}}$

4. Find the n th roots. .

   a) $\sqrt[4]{16}$ b) $-\sqrt[4]{81}$ c) $\sqrt[4]{-81}$ d) $\sqrt[5]{-32x^{20}}$

   e) $\sqrt[4]{x^{16}}$ f) $\sqrt[5]{32}$ g) $\sqrt[4]{256x^{12} y^8}$

5. Simplify. Assume that the variables represent any real number.

   a) $\sqrt{(-6)^2}$ b) $\sqrt[3]{(-27)^3}$ c) $\sqrt{16x^2}$ d) $\sqrt[4]{(x-1)^4}$

6. If $f(x) = \sqrt[3]{x} + 2$, solve as indicated

   a) Find $f(0)$ b) Find $f(-8)$ c) Find domain   d) Graph $f(x)$

Teaching Notes:

- Some students think $\sqrt{4} = +2 \; or -2$. Be sure to define *principal square root* early.
- Some students find higher-order radicals confusing at first.
- Many students are unsure when the absolute value symbol is needed in objective 4.
- Refer students to the ***Finding*** $\sqrt[n]{a^n}$ chart in the text.

Answers: (graph answers at end of mini-lectures) 1a) 5, b) $\dfrac{1}{3}$, c) 0.2, d) -7, e) x, f) 2x², g) 4x⁵, h) -10x¹⁸; 2a) 3.317,

b) 6.083, c) 10.630, d) 14.318; 3a) 2, b) $\dfrac{1}{4}$, c) x², d) -4x³y⁴,   4a) 2, b) -3, c) not a real number, d) x⁴, e) 2, f) 4x³y²;

5a) 6, b) -27, c) 4|x|, d) |x-1|;   6a) 2, b) 0, c) all real numbers

Mini-Lecture 7.2
Rational Exponents

Learning Objectives:

1. Understand the meaning of $a^{\frac{1}{n}}$

2. Understand the meaning of $a^{\frac{m}{n}}$.

3. Understand the meaning of $a^{\frac{-m}{n}}$.

4. Use rules for exponents to simplify expressions that contain rational exponents.

5. Use rational exponents to simplify radical expressions.

Examples:

1. Use radical notation to rewrite each expression. Simplify if possible.

   a) $25^{\frac{1}{2}}$
   b) $8^{\frac{1}{3}}$
   c) $\left(\dfrac{1}{49}\right)^{\frac{1}{2}}$
   d) $(-8)^{\frac{1}{3}}$
   e) $(16x^6)^{\frac{1}{2}}$

2. Simplify if possible. Write final answers with positive exponents.

   a) $81^{\frac{3}{4}}$
   b) $(-8)^{\frac{2}{3}}$
   c) $(32x^5)^{\frac{2}{5}}$
   d) $(-16)^{\frac{3}{2}}$

3. Simplify if possible. Write final answers with positive exponents.

   a) $8^{-\frac{2}{3}}$
   b) $(-64)^{-\frac{4}{3}}$
   c) $\dfrac{1}{x^{-\frac{2}{3}}}$
   d) $\dfrac{3}{4x^{\frac{5}{9}}}$

4. Use the properties of exponents to simplify each expression. Write with positive exponents.

   a) $x^{\frac{4}{3}} \; x^{\frac{5}{3}}$
   b) $y^{\frac{5}{3}} \; y^{-\frac{1}{3}}$
   c) $\dfrac{x^{\frac{3}{5}}}{x^{\frac{1}{10}}}$
   d) $\left(81^{\frac{1}{4}} \; x^{\frac{2}{3}}\right)^3$

   e) $\dfrac{a^{\frac{3}{4}} \; a^{-\frac{1}{2}}}{a^{\frac{4}{3}}}$
   f) $\dfrac{x^{\frac{10}{3}}}{\left(x^4\right)^{\frac{1}{3}}}$
   g) $\dfrac{\left(3x^{\frac{1}{5}}\right)^4}{x^{\frac{3}{10}}}$
   h) $\dfrac{\left(a^{-3} \, b^2\right)^{\frac{1}{8}}}{\left(a^{-2} \, b\right)^{-\frac{1}{4}}}$

5. Use rational exponents to simplify each radical. Assume that all variables represent positive real numbers.

   a) $\sqrt[12]{a^4}$
   b) $\sqrt[4]{25}$
   c) $\sqrt[4]{64x^2}$
   d) $\sqrt[12]{a^6 b^6}$

   Use rational exponents to write as a single radical expression.

   e) $\sqrt[3]{x} \cdot \sqrt{x}$
   f) $\dfrac{\sqrt[8]{y}}{\sqrt[9]{y}}$
   g) $\sqrt[12]{x} \cdot \sqrt[3]{x^2}$
   h) $\sqrt[5]{2x} \cdot \sqrt[3]{y}$

Teaching Notes:

- Most students think rational exponents are easy once they see that the denominator is the root and the numerator is the power.

- Refer students to the **Definition of $a^{\frac{1}{n}}$ / $a^{-\frac{1}{n}}$ / $a^{\frac{m}{n}}$** and **Summary of Exponent Rules** charts in text.

Answers: 1a) $\sqrt{25} = 5$, *b)* $\sqrt[3]{8} = 2$, *c)* $\sqrt{\dfrac{1}{49}} = \dfrac{1}{7}$, *d)* $\sqrt[3]{-8} = -2$, *e)* $\sqrt{16x^6} = 4x^3$, *2a)* 27, *b)* 4, *c)* $4x^2$; *d)* -64; *3a)* $\dfrac{1}{4}$,

b) $\dfrac{1}{256}$, *c)* $x^{\frac{2}{3}}$, *d)* $\dfrac{3x^{\frac{5}{9}}}{4}$; *4a)* x^3, *b)* $y^{\frac{4}{3}}$, *c)* $x^{\frac{1}{2}}$, *d)* $27x^2$, *e)* $\dfrac{1}{a^{\frac{13}{12}}}$, *f)* x^2, *g)* $81x^{\frac{1}{2}}$, *h)* $\dfrac{b^{\frac{1}{2}}}{a^{\frac{7}{8}}}$; *4a)* $\sqrt[3]{a}$, *b)* $\sqrt{5}$, *c)* $2\sqrt{2x}$, *d)*

$\sqrt{ab}$, *e)* $\sqrt[6]{x^5}$, *f)* $\sqrt[72]{y}$, *g)* $\sqrt[4]{x^3}$, *h)* $\sqrt[15]{8x^3 y^5}$

Mini-Lecture 7.3
Simplifying Radical Expressions

Learning Objectives:

1. Use the product rule for radicals.
2. Use the quotient rule for radicals.
3. Simplify radicals.
4. Use the distance and midpoint formulas.

Examples:

1. Use the product rule to multiply. Assume that all variables represent positive real numbers.

   a) $\sqrt{5} \cdot \sqrt{2}$ b) $\sqrt[3]{7} \cdot \sqrt[3]{9}$ c) $\sqrt{5x} \cdot \sqrt{3y}$ d) $\sqrt[4]{5x^3} \cdot \sqrt[4]{4}$

2. Use the quotient rule to simplify. Assume that all variables represent positive real numbers.

   a) $\sqrt{\dfrac{9}{64}}$ b) $\sqrt[4]{\dfrac{x}{16y^4}}$ c) $\sqrt[3]{\dfrac{2}{8x^9}}$ d) $\sqrt{\dfrac{x^{12}}{25y^8}}$ e) $-\sqrt[3]{\dfrac{125x}{y^9}}$

3. Simplify. Assume that all variables represent positive real numbers.

   a) $\sqrt{20}$ b) $\sqrt{48}$ c) $\sqrt{16x^2}$ d) $\sqrt{16x^3}$

   e) $\sqrt{90x^7 y^8}$ f) $\sqrt[3]{54}$ g) $\sqrt[3]{x^4}$ h) $\sqrt[3]{-24x^8 y^{10}}$

   i) $\sqrt[5]{-32x^4 y^{10}}$ j) $\dfrac{\sqrt{80}}{\sqrt{4}}$ k) $\dfrac{\sqrt[3]{81}}{\sqrt[3]{3}}$ l) $\dfrac{\sqrt{x^7 y^3}}{\sqrt{xy}}$

   m) $\dfrac{\sqrt[3]{40x^5 y^9}}{\sqrt[3]{5x^2}}$ n) $\dfrac{\sqrt{50x^2}}{-5\sqrt{25x^{-2}}}$ o) $\dfrac{\sqrt[5]{729x^9 y^3}}{\sqrt[5]{3x^2 y^{-7}}}$

4. Find the distance between each pair of points.

   a) $(2,3)$; $(-2,6)$ b) $(5,-7)$; $(2,-1)$ c) $(3\sqrt{5},2)$; $(7\sqrt{5},3)$

   Find the midpoint of each line segment whose endpoints are given.

   d) $(2,4)$; $(4,3)$ e) $\left(-\dfrac{3}{4},-1\right)$; $\left(-\dfrac{3}{2},-1\right)$ f) $(2\sqrt{5},-5\sqrt{5})$; $(5\sqrt{5},-2\sqrt{5})$

Teaching Notes:

- Some students have trouble simplifying roots with non-perfect squares inside. Encourage them to write numbers as the product of the highest possible perfect square with another number.
- Some students need a lot of practice simplifying radicals with no variables before attempting those with variables.
- Remind students that the root divides the exponent for variables within radicals.
- Refer students to the ***Product / Quotient Rules, Distance Formula,*** and ***Midpoint Formula*** charts.

<u>*Answers:*</u> *1a)* $\sqrt{10}$, *b)* $\sqrt[3]{63}$, *c)* $\sqrt{15xy}$, *d)* $\sqrt[4]{20x^3}$; *2a)* $\dfrac{3}{8}$, *b)* $\dfrac{\sqrt[4]{x}}{2y}$, *c)* $\dfrac{\sqrt[3]{2}}{2x^3}$, *d)* $\dfrac{x^6}{5y^4}$, *e)* $-\dfrac{5\sqrt[3]{x}}{y^3}$; *3a)* $2\sqrt{5}$, *b)* $4\sqrt{3}$, *c)* $4x$,

d) $4x\sqrt{x}$, *e)* $3x^3 y^4 \sqrt{10x}$, *f)* $3\sqrt[3]{2}$, *g)* $x\sqrt[3]{x}$, *h)* $-2x^2 y^3\sqrt[3]{3x^2 y}$, *i)* $-2y^2\sqrt[5]{x^4}$, *j)* $2\sqrt{5}$, *k)* 3, *l)* $x^3 y$, *m)* $2xy^3$, *n)* $\dfrac{x^2\sqrt{2}}{-5}$,

o) $3xy^2\sqrt[5]{x^2}$; *4a)* 5 units, *b)* $\sqrt{45} \approx 6.708$ *units, c)* 9 units, *d)* $(3,\dfrac{7}{2})$, *e)* $(-\dfrac{9}{8},-1)$, *f)* $\left(\dfrac{7\sqrt{5}}{2},-\dfrac{7\sqrt{5}}{2}\right)$

Mini-Lecture 7.4
Adding, Subtracting, and Multiplying Radical Expressions

Learning Objectives:

1. Add or subtract radical expressions.
2. Multiply radical expressions.
3. Key vocabulary: *like radicals.*

Examples:

1. Add or subtract as indicated. Assume that all variables represent positive real numbers.

   a) $\sqrt{63} - \sqrt{7}$

   b) $-3\sqrt{200} - 5\sqrt{8} + 9\sqrt{98}$

   c) $\sqrt{300x^3} - x\sqrt{12x}$

   d) $\sqrt[3]{8x} - \sqrt[3]{27x}$

   e) $7\sqrt[3]{x^3 y^{13}} + 5xy\sqrt[3]{8y^{10}}$

   f) $\dfrac{2\sqrt{2}}{3} + \dfrac{3\sqrt{2}}{5}$

   g) $\dfrac{2x\sqrt{11}}{5} + \sqrt{\dfrac{11x^2}{100}}$

   h) $10\sqrt[4]{x^7} - 2x\sqrt[4]{x^3}$

   i) $\sqrt{\dfrac{20}{x^2}} + \sqrt{\dfrac{5}{4x^2}}$

2. Multiply. Then simplify if possible. Assume that all variables represent positive real numbers.

   a) $\sqrt{6}\left(\sqrt{5} + \sqrt{7}\right)$

   b) $\sqrt{7}\left(\sqrt{11} + \sqrt{7}\right)$

   c) $\left(\sqrt{7} - \sqrt{2}\right)^2$

   d) $\sqrt{2x}\left(\sqrt{2} - \sqrt{x}\right)$

   e) $\left(6\sqrt{y} + z\right)\left(3\sqrt{y} - 1\right)$

   f) $\left(\sqrt[3]{x} + 5\right)\left(\sqrt[3]{x} + 2\right)$

   g) $\left(5\sqrt{3} + 9\right)\left(6\sqrt{3} - 4\right)$

   h) $\left(\sqrt{x-4} + 3\right)^2$

   i) $\left(\sqrt[3]{x} + 7\right)\left(\sqrt[3]{x} - 7\sqrt{x} + 2\right)$

Teaching Notes:

- Most students find objective 1 easy once they realize that adding / subtracting like radicals is analogous to adding / subtracting like terms.
- Some students are not sure how to handle a coefficient in front of a radical once the radical is simplified.
- Many students distribute the exponent in examples 2c) and 2h).

Answers: 1a) $2\sqrt{7}$, b) $23\sqrt{2}$, c) $8x\sqrt{3x}$, d) $-\sqrt[3]{x}$, e) $17xy^4\sqrt[3]{y}$, f) $\dfrac{19\sqrt{2}}{15}$, g) $\dfrac{x\sqrt{11}}{2}$, h) $8x\sqrt[4]{x^3}$, i) $\dfrac{5\sqrt{5}}{2x}$; 2a) $\sqrt{30} + \sqrt{42}$,
b) $\sqrt{77} + 7$, c) $9 - 2\sqrt{14}$, d) $2\sqrt{x} - x\sqrt{2}$, e) $18y + (3z-6)\sqrt{y} - z$, f) $\sqrt[3]{x^2} + 7\sqrt[3]{x} + 10$, g) $54 + 34\sqrt{3}$, h) $x + 5 + 6\sqrt{x-4}$,
i) $\sqrt[3]{x^2} - 7\sqrt[6]{x^5} + 9\sqrt[3]{x} - 49\sqrt{x} + 14$

Mini-Lecture 7.5
Rationalizing Denominators and Numerators of Radical Expressions

Learning Objectives:

1. Rationalize denominators having one term.
2. Rationalize denominators having two terms.
3. Rationalize numerators.
4. Key vocabulary: *rationalize, conjugate.*

Examples:

1. Rationalize each denominator. Assume that all variables represent positive real numbers.

   a) $\dfrac{3}{\sqrt{5}}$

   b) $\sqrt{\dfrac{1}{7}}$

   c) $\dfrac{6}{\sqrt[3]{4}}$

   d) $\dfrac{5}{\sqrt{18x}}$

   e) $-\dfrac{7\sqrt{3}}{\sqrt{11}}$

   f) $\sqrt{\dfrac{23a}{2b}}$

   g) $\dfrac{\sqrt[3]{10x}}{\sqrt[3]{5y^4}}$

   h) $\sqrt[4]{\dfrac{81}{49x^{19}}}$

2. Rationalize each denominator. Assume that all variables represent positive real numbers.

   a) $\dfrac{2}{\sqrt{5}-4}$

   b) $\dfrac{-6}{\sqrt{y}+3}$

   c) $\dfrac{\sqrt{2}+\sqrt{4}}{\sqrt{3}+\sqrt{2}}$

   d) $\dfrac{3\sqrt{x}-2}{3\sqrt{x}-\sqrt{y}}$

3. Rationalize each numerator. Assume that all variables represent positive real numbers.

   a) $\sqrt{\dfrac{5}{2}}$

   b) $\dfrac{\sqrt{2x^7}}{8}$

   c) $\dfrac{\sqrt[3]{6x^2}}{\sqrt[3]{5y}}$

   d) $\sqrt{\dfrac{16x^5y}{4z}}$

   e) $\dfrac{\sqrt{13}+1}{2}$

   f) $\dfrac{3-\sqrt{11}}{-4}$

   g) $\dfrac{\sqrt{x}-1}{\sqrt{x}+1}$

   h) $\dfrac{\sqrt{x}+2\sqrt{y}}{3\sqrt{x}}$

Teaching Notes:

- Some students need to see a few examples of why $\sqrt{a}\cdot\sqrt{a}=a$ before applying it to rationalizing a denominator.
- Most students can rationalize denominators easily for square roots.
- Some students have trouble figuring out what to multiply by when rationalizing higher roots and need a step-by-step procedure.

Answers: 1a) $\dfrac{3\sqrt{5}}{5}$, *b)* $\dfrac{\sqrt{7}}{7}$, *c)* $3\sqrt[3]{2}$, *d)* $\dfrac{5\sqrt{2x}}{6x}$, *e)* $-\dfrac{7\sqrt{33}}{11}$, *f)* $\dfrac{\sqrt{46ab}}{2b}$, *g)* $\dfrac{\sqrt[3]{2xy^2}}{y^2}$, *h)* $\dfrac{3\sqrt[4]{49x}}{7x^5}$; *2a)* $-\dfrac{2(\sqrt{5}+4)}{11}$,

b) $\dfrac{-6\sqrt{y}+18}{y-9}$, *c)* $\sqrt{6}-2+2\sqrt{3}-2\sqrt{2}$, *d)* $\dfrac{9x+3\sqrt{xy}-6\sqrt{x}-2\sqrt{y}}{9x-y}$; *3a)* $\dfrac{5}{\sqrt{10}}$, *b)* $\dfrac{x^4}{4\sqrt{2x}}$, *c)* $\dfrac{6x}{\sqrt[3]{180xy}}$, *d)* $\dfrac{2x^3y}{\sqrt{xyz}}$, *e)* $\dfrac{6}{\sqrt{13}-1}$,

f) $\dfrac{1}{2(3+\sqrt{11})}$, *g)* $\dfrac{x-1}{x+2\sqrt{x}+1}$, *h)* $\dfrac{x-4y}{3x-6\sqrt{xy}}$

Mini-Lecture 7.6
Radical Equations and Problem Solving

Learning Objectives:

1. Solve equations that contain radical expressions.
2. Use the Pythagorean Theorem to model problems.
3. Key vocabulary: *extraneous solution.*

Examples:

1. Solve. Check your solutions.

   a) $\sqrt{4x} = 2$

   b) $\sqrt{x+1} = 7$

   c) $\sqrt{3x} = -6$

   d) $\sqrt{5x+6} + 2 = 8$

   e) $\sqrt[3]{6x} = -4$

   f) $\sqrt[3]{3x+4} - 4 = 0$

   Solve. Check your solutions.

   g) $\sqrt{4x+1} = 3 + \sqrt{x-2}$

   h) $\sqrt{x+20} - \sqrt{x-4} = 4$

   i) $\sqrt{x} + 3 = \sqrt{x+21}$

   j) $\sqrt{4x-3} = \sqrt{x+6}$

   k) $\sqrt{x+1} - \sqrt{x-1} = 2$

   l) $\sqrt[3]{7x-2} = \sqrt[3]{x+8}$

2. Solve.

   a) **Triangle** A triangle has sides of length 12m and 16m. Find the length of the hypotenuse.
   b) **Triangle** A triangle has a hypotenuse of length 25cm and one leg of length 15cm. Find the length of the other leg.
   c) **Kite** A kite is secured to a rope that is tied to the ground. A breeze blows the kite so that the rope is taught while the kite is directly above a flagpole that is 30ft from where the rope is staked down. Find the altitude of the kite if the rope is 110ft long.
   d) **Voltage** The maximum number of volts, E, that can be placed across a resistor is given by $E = \sqrt{PR}$, where P is the power in watts and R is resistance in ohms. If a 2 watt resistor can have at most 40 volts of electricity across it, find the number of ohms of resistance of this resistor.

Teaching Notes:

- Show students a simple example of an extraneous solution, such as:
  $x = 3 \rightarrow x^2 = 9 \rightarrow x = \pm 3 \rightarrow x = -3$ is extraneous.
- Some students have a lot of trouble with objective 2.
- Encourage students to draw a diagram whenever possible for applied problems.
- Refer students to the **Power Rule, Solving a Radical Equation,** and **Pythagorean Theorem** charts in the text.

Answers: 1a) {1}, b) {48}, c) $\varnothing$, d) {6}, e) $\left\{-\dfrac{32}{3}\right\}$, f) {20}, g) {6,2}, h) {5}, i) {4}, j) {3}, k) $\varnothing$, l) $\left\{\dfrac{5}{3}\right\}$; 2a) 20 m

b) 20 cm, c) 105.83 ft, d) 800 ohms of resistance

Mini-Lecture 7.7
Complex Numbers

Learning Objectives:

1. Write square roots of negative numbers in the form bi
2. Add or subtract complex numbers.
3. Multiply complex numbers.
4. Divide complex numbers.
5. Raise i to powers.
6. Key vocabulary: *imaginary number, complex number, complex conjugate.*

Examples:

1. Write using i notation.

   a) $\sqrt{-9}$ b) $\sqrt{-18}$ c) $-\sqrt{4}$ d) $5\sqrt{-20}$

   Write using i notation. Then multiply or divide as indicated.

   e) $\sqrt{-3}\cdot\sqrt{-7}$ f) $\sqrt{25}\cdot\sqrt{-1}$ g) $\sqrt{4}\cdot\sqrt{-64}$ h) $\dfrac{\sqrt{81}}{\sqrt{-6}}$

2. Add or subtract as indicated. Write your answers in $a+bi$ form.

   a) $(3-5i)+(2+4i)$ b) $(8-i)-(2-3i)$ c) $7-(9+3i)$

3. Multiply. Write your answers in $a+bi$ form.

   a) $6i\cdot 8i$ b) $-3i\cdot 5i$ c) $2i\left(4-9i\right)$

   d) $(2+i)(1+4i)$ e) $\left(\sqrt{2}-2i\right)\left(\sqrt{2}+2i\right)$ f) $(3-2i)^2$

4. Divide. Write your answers in $a+bi$ form.

   a) $\dfrac{2}{i}$ b) $\dfrac{3}{7i}$ c) $\dfrac{6}{2+3i}$ d) $\dfrac{3+2i}{4-3i}$

5. Find each power of i.

   a) i^3 b) i^4 c) i^5 d) i^6 e) i^{27} f) $(-2i)^5$

Teaching Notes:

- Most students find objectives 1 and 2 fairly straightforward.
- Encourage students to keep their work neat and organized to avoid errors with objectives 3 and 4.
- Some students have more success with problems 4c) and 4d) if they multiply the complex conjugates off to the side and then put the final result within the problem as they solve it.
- Refer students to the **Sum or Difference of Complex Numbers,** and **Complex Conjugates** charts.

Answers: 1a) 3i, b) $3i\sqrt{2}$, c) -2, d) $10i\sqrt{5}$, e) $-\sqrt{21}$, f) 5i, g) 16i, h) $-\dfrac{3}{2}i\sqrt{6}$; 2a) 5-i, b) 6+2i, c) -2-3i; 3a) -48, b) 15,

c) 18+8i, d) -2+9i, e) 6, f) 5-12i; 4a) -2i, b) $-\dfrac{3}{7}i$, c) $\dfrac{12}{13}-\dfrac{18}{13}i$, d) $\dfrac{6}{25}+\dfrac{17}{25}i$; 5a) –i, b) 1, c) i, d) -1, e) –i, f) -32i

Additional Exercises 7.1
Form I

Name _____

Date _____

Find each root. Assume that all variables represent nonnegative numbers.

1. $\sqrt{64x^8}$

2. $\sqrt[4]{\dfrac{1}{81}}$

3. $\sqrt[3]{\dfrac{64x^3}{8y^6}}$

4. $-\sqrt{625x^2}$

5. $\sqrt{(x+4)^2}$

Simplify. Assume that the variables represent any real numbers.

6. $\sqrt[4]{256x^4}$

7. $\sqrt{49y^4}$

If $f(x) = \sqrt{3x-2}$, find the function value.

8. $f(6)$

9. $f(9)$

(a) Identify the domain and then (b) graph the function.

10. $f(x) = \sqrt{x} - 4$

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____
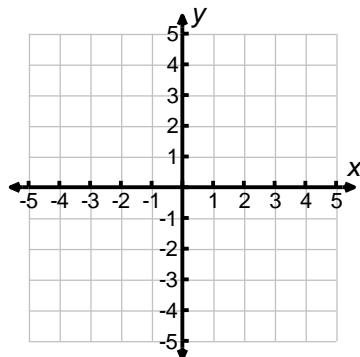
Additional Exercises 7.1
Form II

Name _____

Date _____

Find each root. Assume that all variables represent nonnegative numbers.

1. $\sqrt{100x^{14}}$

2. $-\sqrt[3]{125x^6y^{12}}$

3. $\sqrt[4]{\dfrac{81}{16y^8}}$

4. $\sqrt{-64}$

5. $\sqrt{(-4)^2}$

1. _____

2. _____

3. _____

4. _____

5. _____

Simplify. Assume that the variables represent any real numbers.

6. $\sqrt[5]{x^{15}}$

7. $\sqrt[3]{27x^3y^6}$

6. _____

7. _____

If $f(x) = \sqrt[3]{x-5}$, find the function value.

8. $f(4)$

9. $f(32)$

8. _____

9. _____

(a) Identify the domain and then (b) graph the function.

10. $f(x) = \sqrt{x+1}$

10. _____
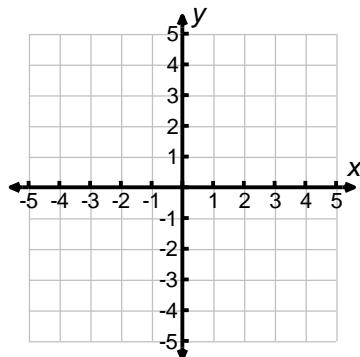
Additional Exercises 7.1
Form III

Name _____

Date _____

Find each root. Assume that all variables represent nonnegative numbers.

1. $\sqrt{\dfrac{81x^{10}}{121y^6}}$

2. $\sqrt[3]{-27x^{12}}$

3. $\sqrt[5]{243a^5b^{15}}$

4. $\sqrt[7]{-2^7}$

5. $\sqrt[5]{-32z^{20}}$

Simplify. Assume that the variables represent any real numbers.

6. $\sqrt{x^2+6x+9}$

7. $-\sqrt{\dfrac{x^{27}}{15y^3}}$

If $f(x) = \sqrt[3]{x-4}$, find the function value.

8. $f(3)$

9. $f(12)$

(a) Identify the domain and then (b) graph the function.

10. $f(x) = \sqrt[3]{x} - 3$

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____
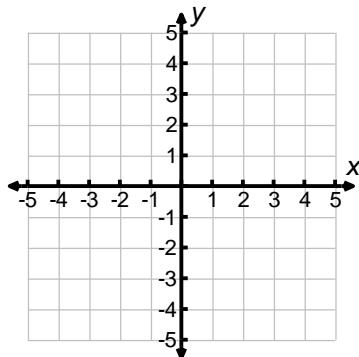
Additional Exercises 7.2
Form I

Name _____

Date _____

Use radical notation to write each expression. Simplify if possible. Assume that all variables represent positive numbers.

1. $64^{\frac{1}{2}}$

2. $\left(\dfrac{1}{27}\right)^{\frac{1}{3}}$

3. $\left(9x^2\right)^{\frac{1}{2}}$

4. $\left(3x^4\right)^{\frac{1}{2}}$

Write with positive exponents. Simplify if possible. Assume that all variables represent positive numbers.

5. $25^{-\frac{1}{2}}$

6. $4^{-\frac{1}{3}}$

7. $x^{-\frac{1}{5}}$

Use the properties of exponents to simplify each expression. Write with positive exponents. Assume that all variables represent positive numbers.

8. $4^{\frac{3}{4}}\cdot 4^{\frac{3}{4}}$

9. $x^{\frac{6}{3}}\cdot x^{-\frac{7}{3}}$

Use rational exponents to simplify each radical. Assume that all variables represent positive numbers.

10. $\sqrt[3]{125x^6}$

11. $\sqrt[8]{16}$

Use rational expressions to write as a single radical expression. Assume that all variables represent positive numbers.

12. $\sqrt{2}\cdot\sqrt[3]{2^2}$

13. $\dfrac{\sqrt[6]{x^5}}{\sqrt[3]{x^2}}$

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

Additional Exercises 7.2
Form II

Name _____

Date _____

Use radical notation to write each expression. Simplify if possible. Assume that all variables represent positive numbers.

1. $-81^{\frac{1}{2}}$

2. $\left(\dfrac{25}{36}\right)^{\frac{3}{2}}$

3. $(9x^{10})^{\frac{1}{2}}$

4. $(3m)^{\frac{1}{5}}$

Write with positive exponents. Simplify if possible. Assume that all variables represent positive numbers.

5. $9^{-\frac{3}{2}}$

6. $25^{-\frac{5}{4}}$

7. $\dfrac{1}{x^{-\frac{1}{3}}}$

Use the properties of exponents to simplify each expression. Write with positive exponents. Assume that all variables represent positive numbers.

8. $10^{\frac{2}{3}} \cdot 10^{\frac{1}{9}}$

9. $\left(81^{\frac{1}{4}} x^{\frac{3}{4}}\right)^{2}$

Use rational exponents to simplify each radical. Assume that all variables represent positive numbers.

10. $\sqrt[3]{x^3 y^6}$

11. $\sqrt[4]{(y-7)^2}$

Use rational expressions to write as a single radical expression. Assume that all variables represent positive numbers.

12. $\sqrt{a} \cdot \sqrt[4]{3b}$

13. $(5x^{\frac{1}{4}} - 4)(3x^{\frac{1}{4}} + 2)$

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

Additional Exercises 7.2
Form III

Name _____

Date _____

Use radical notation to write each expression. Simplify if possible. Assume that all variables represent positive numbers.

1. $(-8)^{\frac{5}{3}}$

2. $(625x^{12}y^2)^{\frac{1}{4}}$

3. $(6x-1)^{\frac{2}{3}}$

4. $(16^{\frac{4}{6}}x^{\frac{2}{3}})^{\frac{3}{4}}$

Write with positive exponents. Simplify if possible. Assume that all variables represent positive numbers.

5. $(-32)^{-\frac{2}{5}}$

6. $\dfrac{1}{a^{-\frac{6}{9}}}$

7. $\dfrac{4}{7y^{-\frac{2}{3}}}$

Use the properties of exponents to simplify each expression. Write with positive exponents. Assume that all variables represent positive numbers.

8. $(3x^{\frac{1}{3}})^2 x^{-\frac{1}{6}}$

9. $(x^2 y)^{\frac{1}{4}} x^{\frac{3}{2}} y^{-\frac{3}{8}}$

Use rational exponents to simplify each radical. Assume that all variables represent positive numbers.

10. $\sqrt[9]{(y+1)^3}$

11. $\sqrt[12]{a^3 b^9}$

Use rational expressions to write as a single radical expression. Assume that all variables represent positive numbers.

12. $\sqrt[4]{x} \cdot \sqrt[3]{x^2} \cdot \sqrt[6]{x^5}$

13. Factor $x^{\frac{2}{3}}$ from $x^{\frac{8}{3}} - x^{\frac{2}{3}}$.

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

Additional Exercises 7.3
Form I

Simplify.

1. $\sqrt{45}$

2. $\sqrt{\dfrac{3}{81}}$

3. $\sqrt{3} \cdot \sqrt{21}$

4. $\sqrt{7y} \cdot \sqrt{7x}$

5. $\sqrt{\dfrac{5}{36x^4}}$

6. $\sqrt{\dfrac{75y^4}{320x^6}}$

7. $\sqrt[3]{128a^4}$

8. $\sqrt[3]{40x^{15}}$

9. $\sqrt[3]{2x^2} \cdot \sqrt[3]{4x^2}$

10. $\sqrt[3]{\dfrac{32y^4}{108x^6}}$

11. $\sqrt[4]{256a^6}$

12. $\sqrt[5]{x^2} \cdot \sqrt[5]{x^8}$

13. $\sqrt[4]{\dfrac{49x^6}{64}}$

14. $\sqrt[4]{z^3} \cdot \sqrt[4]{16z^2} \cdot \sqrt[4]{9z}$

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

14. _____

Additional Exercises 7.3
Form II

Name _____

Date _____

Simplify.

1. $\sqrt[3]{10} \cdot \sqrt[3]{7}$

2. $-\sqrt{27ab^3}$

3. $\sqrt[3]{\dfrac{16}{27}}$

4. $\sqrt[3]{54xy^5} \cdot \sqrt[3]{4x^2 y}$

5. $-\sqrt{\dfrac{128x}{y^8}}$

6. $\sqrt[4]{x^9 y^{16}}$

7. $\sqrt{\dfrac{a^4 b}{121}}$

8. $\dfrac{\sqrt{28x^3}}{\sqrt{7x}}$

9. $\sqrt[4]{3xy^3} \cdot \sqrt[4]{12x^2}$

10. $\sqrt[4]{\dfrac{625x^6}{2401y^{-2}}}$

11. $\sqrt[5]{a^2 b^3} \cdot \sqrt[-5]{a^7 b^4}$

12. $\dfrac{\sqrt[3]{a^2}}{\sqrt[4]{a^7}}$

13. $\sqrt{x^3} \cdot \sqrt[3]{x^2} \cdot \sqrt[6]{x^5}$

14. $\sqrt[5]{\dfrac{32x^9}{243y^{-3}}}$

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

14. _____

Additional Exercises 7.3
Form III

Name _____

Date _____

Simplify.

1. $\sqrt[3]{\dfrac{16}{27}}$

1. _____

2. $\sqrt{\dfrac{3}{a}} \cdot \sqrt{\dfrac{b}{5}}$

2. _____

3. $\sqrt{45m^5 n^4}$

3. _____

4. $\dfrac{12\sqrt[3]{162}}{\sqrt[3]{3}}$

4. _____

5. $\sqrt[5]{-32x^{25} y^7}$

5. _____

6. $\sqrt[5]{128x^3 y} \cdot \sqrt[5]{8x^2 y^4}$

6. _____

7. $\sqrt[4]{\dfrac{y}{256y^4}}$

7. _____

8. $\sqrt[-3]{\dfrac{125x}{y^{12}}}$

8. _____

9. $\sqrt[4]{x^9 y^{16} z^3}$

9. _____

10. $\dfrac{6\sqrt[3]{80x^2}}{3\sqrt[3]{5x^{-1}}}$

10. _____

11. $\sqrt[3]{3y^2} \cdot \sqrt[4]{9x^2 y^5} \cdot \sqrt[6]{3x^3 y}$

11. _____

12. $\sqrt[4]{x^2 y^6 z^6} \cdot \sqrt[6]{x^9 y^3 z^7}$

12. _____

13. $\dfrac{\sqrt[5]{96a^{12} b^4}}{\sqrt[5]{3a^2 b^{-4}}}$

13. _____

14. $\dfrac{\sqrt[8]{9x^4 y^{12}}}{\sqrt[6]{27x^9 y^3}}$

14. _____

Additional Exercises 7.4
Form I

Name _____

Date _____

Add or subtract.

1. $\sqrt{25}+\sqrt{16}$

2. $\sqrt{12}-\sqrt{48}$

3. $\sqrt{32}+\sqrt{72}$

4. $\sqrt{2}-2\sqrt{11}+6\sqrt{2}+4\sqrt{11}$

5. $2\sqrt[3]{10}+4\sqrt[3]{10}$

6. $\sqrt{49x^3}+\sqrt{81x^3}$

7. $\dfrac{\sqrt[3]{27x^6}}{3}+\dfrac{\sqrt[3]{64x^9}}{2\sqrt{x^2}}$

Multiply, and then simplify if possible.

8. $\sqrt{3}\left(\sqrt{2}-\sqrt{5}\right)$

9. $4\sqrt{3}\left(2\sqrt{3}+5\sqrt{2}\right)$

10. $\left(\sqrt{2}-\sqrt{4}\right)\left(\sqrt{8}-\sqrt{9}\right)$

11. $\left(\sqrt{7}+2\sqrt{5}\right)\left(\sqrt{7}-2\sqrt{5}\right)$

12. $\sqrt{2}\left(\sqrt{3}+\sqrt{7}\right)$

13. $\left(\sqrt{x}+\sqrt{y}\right)\left(\sqrt{x}-\sqrt{y}\right)$

14. $\left(\sqrt[3]{24x^2}-6\right)\left(\sqrt[3]{3x^2}+3\right)$

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

14. _____

Additional Exercises 7.4
Form II

Name _____

Date _____

Add or subtract.

1. $3\sqrt{18}-5\sqrt{50}$

2. $4\sqrt{75}+3\sqrt{147}$

3. $x\sqrt{9x}+\sqrt{16x^3}$

4. $\sqrt[3]{2}+8\sqrt[3]{16}-2\sqrt[3]{54}$

5. $x^2\sqrt{25x}+\sqrt{16x^5}$

6. $3\sqrt[3]{2}+8\sqrt{5}+2\sqrt[3]{54}+\sqrt{125}$

7. $\dfrac{\sqrt[3]{x^5}}{3}+\dfrac{3x\sqrt[3]{x^2}}{2}$

Multiply, and then simplify if possible.

8. $\sqrt{2x}\left(\sqrt{6x}-3\sqrt{x}\right)$

9. $4\sqrt[3]{3}\left(9\sqrt[3]{9}+7\sqrt[3]{7}\right)$

10. $\left(3\sqrt{2}-2\sqrt{8}\right)\left(2\sqrt{3}-4\sqrt{5}\right)$

11. $\left(\sqrt{2x}+\sqrt{50}\right)^2$

12. $\left(\sqrt[3]{2}-6\right)\left(\sqrt[3]{4}+3\right)$

13. $\left(\sqrt{63x}-3\right)\left(\sqrt{28x}+2\right)$

14. $\left(\sqrt[3]{4x^2}+\sqrt[3]{2x}\right)\left(\sqrt[3]{2x}-1\right)$

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

14. _____

Additional Exercises 7.4
Form III

Name _____

Date _____

Add or subtract.

1. $3\sqrt{125} - 2\sqrt{20}$

1. _____

2. $\dfrac{\sqrt{2}}{7} + \dfrac{6\sqrt{2}}{5}$

2. _____

3. $\dfrac{\sqrt{18x^4}}{5} + \dfrac{\sqrt{288x^6}}{5x}$

3. _____

4. $3x\sqrt[3]{4x} + 2\sqrt[3]{32x^4}$

4. _____

5. $\dfrac{\sqrt{288x}}{\sqrt[3]{8y^3}} - \dfrac{\sqrt{18x}}{\sqrt[4]{81y^4}}$

5. _____

6. $\sqrt[3]{54x^5} + 2x\sqrt[3]{16x^2} - 7\sqrt[3]{2x^5}$

6. _____

7. $\left(\dfrac{\sqrt{576}}{\sqrt[3]{16}} - \dfrac{\sqrt{144}}{\sqrt[3]{32}} \right)^3$

7. _____

Multiply, and then simplify if possible.

8. $\left(y - \sqrt{2y-5} \right)^2$

8. _____

9. $\left(\sqrt{3y+9} - \sqrt{2y-4} \right)^2$

9. _____

10. $\left(\sqrt[4]{2x-3} + 7 \right)\left(\sqrt[4]{2x-3} - 7 \right)$

10. _____

11. $\left(\sqrt[3]{3x} - 2 \right)\left(\sqrt[3]{9x^2} - 4\sqrt[3]{3x} + 2 \right)$

11. _____

12. $\left(\sqrt[3]{4x^2} - 1 \right)\left(\sqrt[3]{4x^2} - \sqrt[3]{2x} + 2 \right)$

12. _____

13. $\left(\sqrt[3]{x} + 4 \right)\left(\sqrt[3]{x^2} - 4\sqrt[3]{x} + 16 \right)$

13. _____

14. $\left(\dfrac{\sqrt{18x}}{2} - \dfrac{5}{2} \right)\left(\dfrac{\sqrt{8x}}{5} + \dfrac{4}{5} \right)$

14. _____

Additional Exercises 7.5
Form I

Rationalize each denominator.

1. $\dfrac{\sqrt{3}}{\sqrt{5}}$

2. $\sqrt{\dfrac{1}{11}}$

3. $\dfrac{8}{\sqrt{5x}}$

4. $\sqrt{\dfrac{5x}{7y}}$

5. $\dfrac{8}{1-\sqrt{3}}$

6. $\dfrac{\sqrt{y}}{\sqrt{y}-5}$

Rationalize each numerator.

7. $\dfrac{\sqrt{3}}{\sqrt{5}}$

8. $\sqrt{\dfrac{12}{10}}$

9. $\sqrt[3]{\dfrac{5}{8}}$

10. $\dfrac{\sqrt{5x^5}}{4}$

11. $\dfrac{2+\sqrt{2}}{4}$

12. $\dfrac{\sqrt{x}-6}{\sqrt{x}}$

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

Additional Exercises 7.5
Form II

Name _____

Date _____

Rationalize each denominator.

1. $\dfrac{\sqrt{3}}{\sqrt{7}}$

2. $\dfrac{2}{\sqrt[3]{3}}$

3. $\sqrt{\dfrac{14x}{5y^2}}$

4. $\sqrt[3]{\dfrac{4}{9x^2}}$

5. $\dfrac{-2}{\sqrt{x}+3}$

6. $\dfrac{\sqrt{a}}{\sqrt{a}-\sqrt{b}}$

Rationalize each numerator.

7. $\sqrt{\dfrac{5}{13}}$

8. $\sqrt[4]{\dfrac{27}{48}}$

9. $\dfrac{\sqrt{3x^7}}{4}$

10. $\sqrt[3]{\dfrac{25x^2}{16y^4}}$

11. $\dfrac{\sqrt{12}-\sqrt{2}}{\sqrt{3}+\sqrt{2}}$

12. $\dfrac{\sqrt{x}-\sqrt{y}}{\sqrt{x}+\sqrt{y}}$

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

Additional Exercises 7.5
Form III

Rationalize each denominator.

1. $\dfrac{4}{\sqrt{3}-1}$

1. _____

2. $\dfrac{-10\sqrt{3}}{\sqrt{6}}$

2. _____

3. $\sqrt[4]{\dfrac{81}{2x^9}}$

3. _____

4. $\sqrt[3]{\dfrac{6}{4x^4y^2}}$

4. _____

5. $\dfrac{3\sqrt{2}+\sqrt{6}}{4\sqrt{2}-\sqrt{6}}$

5. _____

6. $\dfrac{5\sqrt{x}-5\sqrt{y}}{3\sqrt{x}-4\sqrt{y}}$

6. _____

Rationalize each numerator.

7. $\dfrac{3+\sqrt{10}}{4}$

7. _____

8. $\dfrac{\sqrt{6}+\sqrt{7}}{5}$

8. _____

9. $\sqrt[5]{\dfrac{12}{72}}$

9. _____

10. $\sqrt[3]{\dfrac{16x^5y}{3z}}$

10. _____

11. $\dfrac{7\sqrt{x}-2\sqrt{y}}{4\sqrt{x}+5\sqrt{y}}$

11. _____

12. $\dfrac{\sqrt{6x}-\sqrt{3y}}{\sqrt{3x}+\sqrt{2y}}$

12. _____

Additional Exercises 7.6
Form I

Name _____

Date _____

Solve.

1. $\sqrt{3x} = 6$

2. $\sqrt{2x-1} = 4$

3. $\sqrt{2x+4} - 6 = 0$

4. $4 - \sqrt{x+7} = 2$

5. $\sqrt{7y-5} = \sqrt{7-5y}$

6. $\sqrt{3-5y} = \sqrt{2-8y}$

7. $\sqrt[3]{9x} = -3$

8. $\sqrt[3]{x-2} - 5 = -2$

9. $\sqrt[4]{5x} - 3 = 2$

10. $\sqrt{x-3} = x-5$

11. $z - 4 = \sqrt{3z-2}$

12. $\sqrt{z+4} = \sqrt{z+3} + 1$

13. Find the length of the unknown side in the triangle.

5√7 in.

5√3 in.
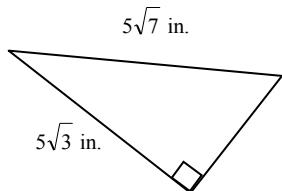
14. The formula $v = \sqrt{2gh}$ gives the velocity v, in feet per second, of an object when it falls h feet accelerated by gravity g, in feet per second squared. If g is approximately 32 feet per second squared, find how far an object has fallen if its velocity is 40 feet per second.

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

14. _____

Additional Exercises 7.6
Form II

Name _____

Date _____

Solve.

1. $\sqrt{5x} = -6$ 1. _____

2. $\sqrt{4-x} - 3 = 0$ 2. _____

3. $\sqrt{3x-1} = 4$ 3. _____

4. $6 - \sqrt{3y-4} = 2$ 4. _____

5. $\sqrt[3]{x+4} = -3$ 5. _____

6. $\sqrt{8x+5} - 8 = 21$ 6. _____

7. $\sqrt{7-6x} = 3 - 2x$ 7. _____

8. $\sqrt{y-7} = 7 - \sqrt{y}$ 8. _____

9. $\sqrt{a-5} + \sqrt{a-8} = 3$ 9. _____

10. $\sqrt{x-4} + \sqrt{x+4} = 4$ 10. _____

11. $\sqrt{y+8} = \sqrt{y-4} + 2$ 11. _____

12. $\sqrt[3]{5x-9} - 4 = -3$ 12. _____

13. Find the length of the unknown side in the triangle.   13. _____

8 m

4 m

14. The formula for the period of a pendulum, P, in seconds, is   14. _____

$P = 2\pi\sqrt{\dfrac{l}{32}}$, where l is the length of the pendulum in feet. What is the length of a pendulum whose period is π seconds?

Additional Exercises 7.6
Form III

Solve.

1. $\sqrt{20x} = x$

2. $\sqrt{5x+6} = 7$

3. $\sqrt{9x-5} - 8 = 0$

4. $\sqrt{8x-3} + 9 = 5$

5. $\sqrt[3]{x^2 + 6x} = -2$

6. $\sqrt{8x-7} = 2x - 3$

7. $\sqrt{b+3} = \sqrt{b} - 3$

8. $\sqrt{4z-3} - \sqrt{8z+1} + 2 = 0$

9. $2\sqrt{3y-2} + \sqrt{2y-3} = 5$

10. $\sqrt{7y+2} - \sqrt{3y-3} = 3$

11. $\sqrt{\dfrac{y}{4} + 3} = 5 - \sqrt{\dfrac{y}{4} - 2}$

12. $\sqrt{y+1 + \sqrt{7y+4}} = 3$

13. To the nearest tenth of a meter, find the length of the unknown side in the triangle.

9 m

12 m
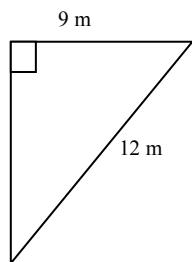
14. A wire is needed to support a telephone pole that is 23 feet high. The cable will be anchored to a stake that is 7.5 feet from the base of the pole. To the nearest tenth of a foot, how much cable is needed?

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

14. _____

Additional Exercises 7.7
Form I

Name _____

Date _____

Write in terms of i.

1. $\sqrt{-18}$

2. $\sqrt{-144}$

3. $5\sqrt{-12}$

Perform the indicated operation. Write answers in the form $a + bi$.

4. $\sqrt{-3} \cdot \sqrt{-6}$

5. $\sqrt{-15} \cdot \sqrt{-5}$

6. $\dfrac{\sqrt{-200}}{\sqrt{5}}$

7. $(3 - 2i) + (5 + i)$

8. $(6 - i) + (3 + 7i)$

9. $\left(4 - i\sqrt{2}\right) + \left(6 + 3i\sqrt{2}\right)$

10. $4i(1 - 2i)$

11. $(7 + 4i)(7 - 4i)$

12. $(2 + 3i)^2$

13. $\dfrac{3 - i}{2i}$

Simplify. Find each power of i.

14. i^{31}

15. i^{-11}

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

14. _____

15. _____

Additional Exercises 7.7
Form II

Name _____

Date _____

Write in terms of i.

1. $\sqrt{-72}$

2. $\sqrt{-\dfrac{9}{16}}$

3. $10\sqrt{-48}$

Perform the indicated operation. Write answers in the form $a + bi$.

4. $\sqrt{-12} \cdot \sqrt{-48}$

5. $\sqrt{-10} \cdot \sqrt{-15}$

6. $\dfrac{\sqrt{-400}}{\sqrt{-20}}$

7. $(7 + 2i) - (1 - 4i)$

8. $(8 + 14i) - (-3 - 6i)$

9. $\left(2 + i\sqrt{3}\right) + \left(7 + 4i\sqrt{3}\right)$

10. $7i(3 - 5i)$

11. $(6 - 2i)(3 + 5i)$

12. $(5 + 7i)^2$

13. $\dfrac{4}{6 + 2i}$

Simplify. Find each power of i.

14. i^{47}

15. i^{-37}

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

14. _____

15. _____

Additional Exercises 7.7
Form III

Name _____

Date _____

Write in terms of i.

1. $\sqrt{-63}$

2. $-\sqrt{-\dfrac{4}{9}}$

3. $2\sqrt{-512}$

Perform the indicated operation. Write answers in the form $a + bi$.

4. $\dfrac{5}{i}$

5. $\sqrt{-39} \cdot \sqrt{-78}$

6. $\left(3\sqrt{-5}\right) \cdot \left(-4\sqrt{-12}\right)$

7. $(9 + 13i) - (-7 - 15i)$

8. $\left(5 + 2i\sqrt{32}\right) - \left(11 - 5i\sqrt{8}\right)$

9. $\left(4 - 2i\sqrt{147}\right) - \left(11 - 8i\sqrt{12}\right)$

10. $(12i)(-3i)$

11. $(3 + 5i)(3 - 5i)$

12. $(6 - 9i)^2$

13. $\dfrac{-4 + 7i}{-2 - 5i}$

Simplify. Find each power of i.

14. i^{22}

15. $i^{12} - i^{22}$

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

14. _____

15. _____

Section 7.1 Radicals and Radical Functions

Objective: Find values and roots with different indices..
Suggested Format: Think and Pair
Time: 20 minutes

Simplify each root. Assume that variables represent positive real numbers.

1. $-\sqrt{40}$ **1.** _____

2. $\sqrt{49y^{12}}$ **2.** _____

3. $\sqrt[3]{16x^6}$ **3.** _____

4. $\sqrt{64(3x-5)^8}$ **4.** _____

5. $\sqrt[5]{-243}$ **5.** _____

Use $f(x)=\sqrt{3x+1}$ for question 6 – 8.

6. Find $f(0)$.   **6.** _____

7. Find $f(3)$.   **7.** _____

8. Find $f(-2)$.   **8.** _____

9. Find the length indicated by x. Round your   **10.** _____
    answer to the nearest hundredth.
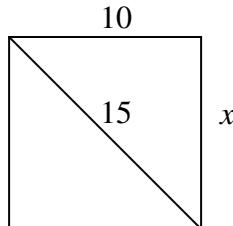
Section 7.6 Rational Equations and Problem Solving

Objective: Apply knowledge of solving equations with radicals to real life examples..
Suggested Format: Small Group
Time: 15 minutes

An accident investigator is often responsible for determining the speed at which a vehicle was traveling before colliding with another object. Investigators use the formula:
$S = 5.5\sqrt{cd}$ where S is the speed of the vehicle (in miles per hour), c is the coefficient of friction between the surface of the road and the tires of the vehicle, and d stands for the length of the longest skid mark on the surface (in feet). If the road is dry the value of c normally ranges between 0.69 and 0.75 for most cars.

1. Find the speed of a car that left a 32-foot long skid mark before hitting a tree. Let $c = 0.72$.

                                                    Speed _____

2. A defendant in a vehicular homicide trial is arguing that he was not traveling over 40 mph when he struck another vehicle. What is the maximum length of the skid mark could leave if this was so? (Assume roads were dry and $c = 0.72$.)

                                                    Length of skid mark _____

Chapter 7 Test Form A

Raise to the power or take the root. Assume that all variables represent positive numbers. Write your answers using only positive exponents.

1. $\sqrt{320}$

                                                     1. _____

2. $\sqrt[3]{-540x^{15}y^{20}}$

                                                     2. _____

3. $\left(\dfrac{1}{625}\right)^{-\frac{1}{4}}$

                                                     3. _____

4. $-\sqrt{196x^3y^4z}$

                                                     4. _____

5. $a^{\frac{2}{3}}\left(a^{\frac{1}{3}}+a^{\frac{1}{2}}\right)$

                                                     5. _____

6. $\left(\dfrac{36a^{\frac{5}{3}}}{b^{\frac{2}{5}}c^{-\frac{1}{3}}}\right)^{\frac{1}{2}}$

                                                     6. _____

Simplify. Use absolute value bars when necessary.

7. $\sqrt{36a^2b^4}$

                                                     7. _____

Rationalize the denominator. Assume that all variables represent positive numbers.

8. $\sqrt{\dfrac{50x^3}{2}}$

                                                     8. _____

9. $\dfrac{\sqrt[3]{ab^2}}{\sqrt[3]{4a^2b}}$

                                                     9. _____

10. $\dfrac{\sqrt{3}-3\sqrt{2}}{\sqrt{3}+\sqrt{2}}$

                                                     10. _____

Use a calculator to approximate the number to three decimal places.

11. $210^{-\frac{3}{4}}$

                                                     11. _____

Chapter 7 Test Form A *cont'd*

Perform the indicated operations. Assume that all variables represent positive numbers.

12. $\sqrt{48x^2yz^3} + x\sqrt{3yz^3}$ **12.** _____

13. $\sqrt[3]{54} - \sqrt[3]{128}$ **13.** _____

14. $2\sqrt{5}\left(3\sqrt{20} - \sqrt{10}\right)$ **14.** _____

15. $\left(4\sqrt{x} - 3\sqrt{2}\right)^2$ **15.** _____

16. $\left(4\sqrt{x} + 2\sqrt{y}\right)\left(4\sqrt{x} - 2\sqrt{y}\right)$ **16.** _____

Perform the indicated operation and simplify. Write the result in the form $a + bi$.

17. $\sqrt{-20}$ **17.** _____

18. $\left(4 + 3i\right) - \left(6 - 5i\right)$ **18.** _____

19. $\left(4 - 3i\right)^2$ **19.** _____

20. $\dfrac{2 - 6i}{3 + i}$ **20.** _____

Solve each equation.

21. $\sqrt{3x - 7} = \sqrt{2x + 5}$ **21.** _____

22. $\sqrt{4x + 1} - 5 = 2$ **22.** _____

23. $x - 2 = \sqrt{2x - 5}$ **23.** _____

24. Find the distance between the two points   **24.** _____
     (−5, 4) and (3, 8)

25. Find the midpoint between the two points.   **25.** _____
     (3, 6) and (−4, 8)

Chapter 7 Test Form B

Raise to the power or take the root. Assume that all variables represent positive numbers.
Write your answers using only positive exponents.

1. $-\sqrt{\dfrac{49x^2}{36}}$ 1. _____

2. $\sqrt[3]{\dfrac{-128x^9 y^{14}}{27}}$ 2. _____

3. $\left(\dfrac{16}{9}\right)^{-\frac{3}{2}}$ 3. _____

4. $\left(\dfrac{y^{\frac{1}{4}} \cdot y^{\frac{1}{2}}}{y^{-\frac{3}{4}}}\right)$ 4. _____

5. $x^{\frac{1}{5}}\left(x^{\frac{4}{5}} + x^{\frac{2}{3}}\right)$ 5. _____

Simplify. Use absolute value bars when necessary.

6. $\sqrt[5]{x^{15}}$ 6. _____

7. $\sqrt[4]{81(x+y)^4}$ 7. _____

Perform the indicated operations. Assume that all variables represent positive numbers.

8. $2\sqrt[3]{24a^4} - a\sqrt[3]{81a}$ 8. _____

9. $\left(3\sqrt{x} - 2\right)^2$ 9. _____

10. $\left(2\sqrt{a} - \sqrt{3}\right)\left(2\sqrt{a} + \sqrt{3}\right)$ 10. _____

11. $\left(2\sqrt{2} - \sqrt{5}\right)\left(\sqrt{2} + 3\sqrt{5}\right)$ 11. _____

Chapter 7 Test Form B *cont'd*

Rationalize the denominator. Assume that all variables represent positive numbers.

12. $\sqrt{\dfrac{12x^3}{7y^5}}$ **12.** _____

13. $\dfrac{\sqrt{5}-\sqrt{3}}{\sqrt{5}+\sqrt{3}}$ **13.** _____

Rationalize the numerator. Assume that all variables represent positive numbers.

14. $\dfrac{x-\sqrt{2}}{2}$ **14.** _____

Perform the indicated operation and simplify. Write the result in the form $a+bi$.

15. $-\sqrt{-24}$ **15.** _____

16. $(14-5i)-(8+4i)$ **16.** _____

17. $2i(3-i)$ **17.** _____

18. $(2-5i)(3+4i)$ **18.** _____

19. $\dfrac{2+i}{3i}$ **19.** _____

20. $\dfrac{1+2i}{5-4i}$ **20.** _____

Solve each equation.

21. $\sqrt{x+5}=x-1$ **21.** _____

22. $\sqrt[3]{x+5}=-2$ **22.** _____

23. $\sqrt{2x-4}+6=0$ **23.** _____

24. Find the distance between the two points   **24.** _____
(5, 3) and (−3, −2)

25. Find the midpoint between the two points.   **25.** _____
(−5, 4) and (−12, 8)

Chapter 7 Test Form C

Raise to the power or take the root. Assume that all variables represent positive numbers. Write your answers using only positive exponents.

1. $\sqrt{24a^6 b^{17} c^5}$

1. _____

2. $\sqrt[3]{-125x^{15} y^8}$

2. _____

3. $\left(\dfrac{8x^3}{27y^6} \right)^{-\frac{2}{3}}$

3. _____

4. $\left(\dfrac{x^{\frac{1}{3}} x^{-\frac{1}{2}}}{x^{\frac{4}{3}}} \right)^{-2}$

4. _____

Simplify. Use absolute value bars when necessary.

5. $\sqrt[3]{-x^3}$

5. _____

6. $\sqrt[4]{(2x)^4}$

6. _____

Rationalize the denominator. Assume that all variables represent positive numbers.

7. $\sqrt[3]{\dfrac{6y}{4x^2}}$

7. _____

8. $\dfrac{2}{3-\sqrt{x}}$

8. _____

9. $\dfrac{\sqrt{6}+\sqrt{3}}{\sqrt{6}-\sqrt{3}}$

9. _____

Use a calculator to approximate the number to three decimal places.

10. $102^{\frac{2}{3}}$

10. _____

Perform the indicated operations. Assume that all variables represent positive numbers.

11. $\sqrt[3]{250x^4} - 2x\sqrt[3]{432x}$

11. _____

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Chapter 7 Test Form C *cont'd*

12. $\sqrt{6}\left(\sqrt{15}+\sqrt{70}\right)$ 12. _____

13. $\left(3\sqrt{2}-4\right)^{2}$ 13. _____

14. $\left(2\sqrt{x}+\sqrt{y}\right)\left(3\sqrt{x}-2\sqrt{y}\right)$ 14. _____

15. $\left(\sqrt{2x}-3\right)\left(\sqrt{2x}+3\right)$ 15. _____

Solve each equation.

16. $\sqrt{12x-48}=4$ 16. _____

17. $\sqrt{x+2}=1+\sqrt{x-3}$ 17. _____

18. $\sqrt[3]{2x-1}=3$ 18. _____

Perform the indicated operation and simplify. Write the result in the form $a+bi$.

19. $2-\left(10+3i\right)+\left(5-8i\right)$ 19. _____

20. $5i\left(2-3i\right)$ 20. _____

21. $\left(3-6i\right)\left(2+4i\right)$ 21. _____

22. $\dfrac{5-2i}{3i}$ 22. _____

23. $\dfrac{2+4i}{3-i}$ 23. _____

24. Find the distance between the two points   24. _____
(−2, 5) and (6, 3)

25. Find the midpoint between the two points.   25. _____
(8, −3) and (14, −11)

Chapter 7 Test Form D

Circle the correct answer.

Raise to the power or take the root. Assume that all variables represent positive numbers.

1. $-\sqrt{28}$

    a. $2i\sqrt{7}$ **b.** $-2\sqrt{7}$ **c.** $-2i\sqrt{7}$ **d.** not a real number

2. $\sqrt[4]{256a^5 b^{16}}$

    a. $16b^2 \sqrt[4]{a^5}$ **b.** $64ab^4 \sqrt[4]{a}$ **c.** $4ab^4 \sqrt[4]{a}$ **d.** $64ab^2 \sqrt[4]{a^5}$

3. $\sqrt[3]{-64a^9 b^8}$

    a. $-4a^3 b^2$ **b.** $-4a^3 b^2 \sqrt[3]{b^2}$ **c.** $-8a^3 b^4$ **d.** not a real number

4. $\left(\dfrac{32a^{10}}{243b^{-5}} \right)^{-\frac{1}{5}}$

    a. $\dfrac{2a^2}{3b}$ **b.** $\dfrac{2a^2 b}{3}$ **c.** $\dfrac{3a^2 b}{2}$ **d.** $\dfrac{3}{2a^2 b}$

5. $x^{\frac{3}{4}} \left(x^{\frac{2}{3}} + x^{\frac{1}{4}} \right)$

    a. $x^{\frac{17}{12}} + x$ **b.** $x^{\frac{29}{12}}$ **c.** $x^{\frac{1}{2}} + x^{\frac{3}{16}}$ **d.** $x^{\frac{1}{2}} + x$

Simplify.

6. $\sqrt[4]{81(x-y)^4}$

    a. $9(x-y)$ **b.** $3|x-y|$ **c.** $3(x-y)$ **d.** $9|x-y|$

Chapter 7 Test Form D *cont'd*

Perform the indicated operations. Assume that all variables represent positive numbers.

7. $\sqrt{98x^5} - 2x\sqrt{18x^3}$

     a. $x\sqrt{2x}$ **b.** $5x\sqrt{2x^3}$ **c.** $x^2\sqrt{2x}$ **d.** $5x^2\sqrt{2x}$

8. $\sqrt[3]{192} + \sqrt[3]{375}$

     a. $\sqrt[3]{567}$ **b.** $-\sqrt[3]{3}$ **c.** $8\sqrt[3]{3} + 5\sqrt[3]{15}$ **d.** $9\sqrt[3]{3}$

9. $\left(\sqrt{2x} - 4\right)^2$

     a. $2x - 2\sqrt{8x} + 16$ **b.** $2x - 8\sqrt{2x} + 16$ **c.** $2x - 4\sqrt{2x} + 16$ **d.** $2x - 4\sqrt{x} + 16$

10. $\left(\sqrt{3} + 7\right)\left(\sqrt{2} - 1\right)$

     a. $\sqrt{6} - \sqrt{3} + 7\sqrt{2} - 7$ **b.** $\sqrt{3} + 7\sqrt{x} - 7$
     c. $\sqrt{6} + \sqrt{3} + 7\sqrt{2} - 7$ **d.** $7\sqrt{5} - 7$

11. $\left(\sqrt{5} + 4\right)\left(\sqrt{5} - 4\right)$

     a. 3 **b.** -11 **c.** $\sqrt{5} - 16$ **d.** 9

Use a calculator to approximate each to 3 decimal places.

12. $\sqrt{217}$
     a. 14.799 **b.** 14.731 **c.** 14.832 **d.** 14.765

13. $140^{-\frac{1}{3}}$

     a. 0.291 **b.** 0.004 **c.** 0.193 **d.** 0.197

Chapter 7 Test Form D *cont'd*

Rationalize the denominator. Assume that all variables represent positive numbers.

14. $\dfrac{2}{\sqrt{5}}$

      a. $\dfrac{2\sqrt{5}}{5}$ **b.** $2\sqrt{5}$ **c.** $\dfrac{2}{5}$ **d.** $\dfrac{\sqrt{10}}{5}$

15. $\dfrac{\sqrt{x}+3}{2\sqrt{x}-1}$

      a. $\dfrac{2x+5\sqrt{x}-3}{4x-1}$ **b.** $\dfrac{2x+7\sqrt{x}-3}{2x-1}$ **c.** $\dfrac{2x+7\sqrt{x}+3}{4x-1}$ **d.** $\dfrac{2x+7\sqrt{x}+3}{2x-1}$

16. $\dfrac{\sqrt[3]{x}}{\sqrt[3]{xy}}$

      a. $\dfrac{\sqrt[3]{y^2}}{xy}$ **b.** $\dfrac{\sqrt[3]{y^2}}{y}$ **c.** $\dfrac{x\sqrt[3]{y^2}}{y}$ **d.** $\dfrac{x\sqrt[3]{xy}}{y}$

Solve.

17. $\sqrt{3x+6}+6=3$

    a. 25   **b.** 0   **c.** $-\dfrac{20}{3}$ **d.** Ø

18. $\sqrt{3x+8}=\sqrt{7x-32}$

    a. 8   **b.** 10   **c.** –6   **d.** Ø

19. $x=\sqrt{x-5}+5$

    a. 5   **b.** –5, 6   **c.** 5, 6   **d.** 0, 5

Perform the indicated operation and simplify. Write the result in the form $a+bi$.

20. $(4-5i)-(6-3i)$

    a. $-2-2i$ **b.** $-2-8i$ **c.** $10-8i$ **d.** 9

Chapter 7 Test Form D *cont'd*

21. $(5-2i)(4+3i)$

   a. $9+i$ **b.** $26+7i$ **c.** $14+7i$ **d.** $14+23i$

22. $\dfrac{6-i}{2i}$

   a. 3   **b.** 2   **c.** $-\dfrac{1}{2}-3i$ **d.** $\dfrac{1}{2}+3i$

23. $\dfrac{2+3i}{2+i}$

   a. 4   **b.** $\dfrac{7}{5}-\dfrac{4}{5}i$ **c.** $\dfrac{7}{3}-\dfrac{4}{3}i$ **d.** $\dfrac{7}{3}+\dfrac{4}{3}i$

24. Find the distance between the two points (3, 5) and (−4, 6).

   a. $5\sqrt{2}$ **b.** 25   **c.** $\sqrt{2}$ **d.** $2\sqrt{5}$

25. Find the midpoint between the two points (−7, 5) and (−8, −4)

   a. $\left(-\dfrac{1}{2},\dfrac{9}{2}\right)$ **b.** $\left(-\dfrac{3}{2},-\dfrac{11}{2}\right)$ **c.** $\left(-\dfrac{15}{2},\dfrac{1}{2}\right)$ **d.** $(-7,-4)$

Chapter 7 Test Form E

Circle the correct answer.

Raise to the power or take the root. Assume that all variables represent positive numbers.

1. $\sqrt{48x^{12}y^{16}}$

     a. $2y^2\sqrt{12x^{12}}$ **b.** $24x^6y^8$ **c.** $4x^6y^8\sqrt{3}$ **d.** $4x^2y^4\sqrt{3x}$

2. $\sqrt[5]{64x^8y^{11}z^2}$

     a. $2xy^2\sqrt[5]{2x^3yz^2}$ **b.** $4x\sqrt[5]{x^3y^6z^2}$ **c.** $2xy^2\sqrt[5]{xyz^2}$ **d.** $12xy^2\sqrt[5]{4x^3yz^2}$

3. $(9)^{-\frac{3}{2}}$

     a. $\dfrac{1}{27}$ **b.** -27 **c.** $\dfrac{1}{9}$ **d.** $-\dfrac{1}{9}$

4. $\dfrac{x^{\frac{2}{3}}x^{\frac{2}{5}}}{x^{\frac{1}{2}}}$

     a. $x^{\frac{8}{15}}$ **b.** $x^{\frac{17}{30}}$ **c.** $x^{\frac{13}{30}}$ **d.** $x^{\frac{11}{15}}$

5. $\left(\dfrac{4x^{\frac{1}{2}}}{y^{\frac{2}{3}}z^{-\frac{2}{5}}}\right)^{\frac{1}{2}}$

     a. $\dfrac{4x^{\frac{1}{4}}y^{\frac{1}{3}}}{z^{\frac{1}{5}}}$ **b.** $\dfrac{2x^{\frac{1}{2}}y^{\frac{1}{5}}}{z^{\frac{1}{3}}}$ **c.** $\dfrac{4x^{\frac{1}{4}}z^{\frac{1}{5}}}{y^{\frac{1}{3}}}$ **d.** $\dfrac{2x^{\frac{1}{4}}z^{\frac{1}{5}}}{y^{\frac{1}{3}}}$

6. $x^{\frac{2}{5}}\left(x^{\frac{1}{5}}-x^{\frac{3}{5}}\right)$

     a. $x^{\frac{2}{25}}-x^{\frac{6}{25}}$ **b.** $x^{\frac{3}{5}}-x$ **c.** $x^{\frac{3}{5}}-x^{\frac{1}{5}}$ **d.** $x^{\frac{1}{5}}-x^{\frac{6}{5}}$

Chapter 7 Test Form E *cont'd*

7. Simplify. $\sqrt{(5x)^2}$

    a. $5|x|$ **b.** $5x$ **c.** $5x^2$ **d.** $25x^2$

Use a calculator to approximate to 3 decimal places.

8. $\sqrt{211}$

    a. 14.525   **b.** 14.217   **c.** 14.526   **d.** 14.539

Rationalize the denominator. Assume that all variables represent positive numbers.

9. $\sqrt{\dfrac{2}{3}}$

    a. $\dfrac{\sqrt{6}}{3}$ **b.** $\sqrt{2}$ **c.** $\dfrac{2\sqrt{3}}{3}$ **d.** $\dfrac{\sqrt{2}}{3}$

10. $\dfrac{\sqrt{x}+1}{\sqrt{x}+2}$

    a. $\dfrac{x+\sqrt{x}-2}{x-4}$ **b.** $\dfrac{x-\sqrt{x}-2}{x-4}$ **c.** $\dfrac{x-\sqrt{x}-x}{x+4}$ **d.** $\dfrac{x-\sqrt{x}-2}{x-2}$

11. $\sqrt[3]{\dfrac{4x}{9y^2}}$

    a. $\dfrac{2\sqrt[3]{x}}{3y}$ **b.** $4x$ **c.** $\dfrac{\sqrt[3]{12xy}}{3y}$ **d.** $\sqrt[3]{4x}$

Perform the indicated operations. Assume that all variables represent positive numbers.

12. $7x\sqrt{3x}-\sqrt{75x^3}$

    a. $2x^2\sqrt{3}$ **b.** $12x\sqrt{3x}$ **c.** $2x\sqrt{3x}$ **d.** $2\sqrt{3x}$

13. $\sqrt{5}\left(\sqrt{10}-\sqrt{2}\right)$

    a. $\sqrt{2}-\sqrt{5}$ **b.** $5\sqrt{2}-\sqrt{10}$ **c.** $5\sqrt{2}-10$ **d.** $2\sqrt{5}-\sqrt{10}$

Chapter 7 Test Form E *cont'd*

14. $\left(7-2\sqrt{x}\right)\left(7+2\sqrt{x}\right)$

    a. $49-4x$ **b.** $49-28\sqrt{x}+4x$ **c.** $49+28\sqrt{x}+4x$ **d.** $40+4x$

Solve.

15. $\sqrt{3x-2}=\sqrt{2x+10}$

    a. 12 **b.** 8 **c.** 2 **d.** Ø

16. $\sqrt{6-2x}-6=3$

    a. $-\dfrac{39}{2}$ **b.** $-\dfrac{15}{2}$ **c.** $-\dfrac{75}{2}$ **d.** Ø

17. $\sqrt{x+3}=x-3$

    a. $1,6$ **b.** 6 **c.** 1 **d.** Ø

Perform the indicated operation and simplify. Write the result in the form $a+bi$.

18. $\sqrt{-16}$

    a. $-2i$ **b.** $2i$ **c.** -4 **d.** $4i$

19. $\left(12+5i\right)-\left(3-2i\right)$

    a. $9+3i$ **b.** $15+3i$ **c.** $9+7i$ **d.** $46-9i$

20. $\left(2-5i\right)^{2}$

    a. $29+10i$ **b.** $-21-20i$ **c.** $-21-10i$ **d.** $29-20i$

Chapter 7 Test Form E *cont'd*

21. $(8-4i)(7+2i)$

    a. $48-12i$ **b.** $15-2i$ **c.** $64-12i$ **d.** $56-20i$

22. $\dfrac{3-6i}{2i}$

    a. 0 **b.** $-3+6i$ **c.** $3i$ **d.** $-3-\dfrac{3}{2}i$

23. $\dfrac{2-3i}{2+6i}$

    a. $-\dfrac{7}{20}-\dfrac{9}{20}i$ **b.** $\dfrac{1}{2}-\dfrac{1}{2i}$ **c.** $\dfrac{1}{2}-\dfrac{6}{5}i$ **d.** $-\dfrac{13}{10}+\dfrac{6}{5}i$

24. Find the distance between the two points (3, 5) and (7, 8).

    a. 25 **b.** $\sqrt{5}$ **c.** 5 **d.** $\sqrt{269}$

25. Find the midpoint between the two points (5, −7) and (−3, −9)

    a. $(2, -16)$ **b.** $(4, 1)$ **c.** $(1, -8)$ **d.** $(-4, -1)$

Chapter 7 Test Form F

Circle the correct answer.

Raise to the power or take the root. Assume that all variables represent positive numbers.

1. $\sqrt{36x^8 y^{12}}$

    a. $6x^4 y^2 \sqrt{xy}$ **b.** $18x^9 y^6$ **c.** $6x^4 y^6$ **d.** $6x^6 y^6 \sqrt{xy}$

2. $\sqrt[3]{32x^{10} y^{12}}$

    a. $2x^3 y^4 \sqrt[3]{x}$ **b.** $2x^3 y^4 \sqrt[3]{4x}$ **c.** $10x^3 y^4 \sqrt[3]{2x}$ **d.** $3x^2 y^2 \sqrt[3]{5xy^3}$

3. $\left(\dfrac{x^{\frac{2}{3}}}{y^{-\frac{1}{3}}} \right)^9$

    a. $\dfrac{1}{x^6 y^3}$ **b.** $x^6 y^3$ **c.** $\dfrac{x^6}{y^3}$ **d.** $\dfrac{y^3}{x^6}$

4. $x^{-\frac{1}{3}} \left(x^{\frac{7}{3}} - x^4 \right)$

    a. $x^{\frac{7}{9}} - x^{\frac{4}{3}}$ **b.** $x^2 - x^{\frac{13}{3}}$ **c.** $x^{\frac{8}{3}} - x^{\frac{13}{3}}$ **d.** $x^2 - x^{\frac{11}{3}}$

5. $\left(16x^2 y^{-8} \right)^{\frac{3}{4}}$

    a. $8x^9 y^6$ **b.** $12x^9 y^6$ **c.** $\dfrac{12x^9}{y^6}$ **d.** $\dfrac{8x^{\frac{3}{2}}}{y^6}$

Simplify.

6. $\sqrt[4]{(2x-y)^4}$

    a. $|2x-y|$ **b.** $(2x-y)^2$ **c.** $(2x-y)^2$ **d.** $2x-y$

Chapter 7 Test Form F *cont'd*

Rationalize the denominator. Assume that all variables represent positive numbers.

7. $\dfrac{7}{\sqrt[3]{9}}$

    a. $\dfrac{7\sqrt[3]{3}}{27}$ **b.** $\dfrac{7\sqrt[3]{3}}{3}$ **c.** $\dfrac{7\sqrt[3]{3}}{9}$ **d.** $\dfrac{7\sqrt[3]{9}}{81}$

8. $\sqrt{\dfrac{5x}{2y}}$

    a. $\dfrac{5\sqrt{xy}}{y}$ **b.** $\dfrac{10\sqrt{xy}}{2y}$ **c.** $\sqrt{5x}$ **d.** $\dfrac{\sqrt{10xy}}{2y}$

9. $\dfrac{\sqrt{6}-\sqrt{2}}{\sqrt{6}+\sqrt{2}}$

    a. $1-\dfrac{\sqrt{3}}{2}$ **b.** $2+\sqrt{3}$ **c.** $2-\sqrt{3}$ **d.** $2-2\sqrt{3}$

Use a calculator to approximate to 3 decimal places.

10. $\sqrt[3]{174}$

    a. 5.593   **b.** 5.583   **c.** 3.637   **d.** 5.615

Perform the indicated operations. Assume that all variables represent positive numbers.

11. $\sqrt[4]{80x^6}+3x\sqrt[4]{405x^2}$

    a. $11x\sqrt[4]{5x^2}$ **b.** $5x\sqrt[4]{5x^2}$ **c.** $9x\sqrt[4]{5x^2}$ **d.** $-7x\sqrt[4]{5x}$

12. $\left(\sqrt{2x}-3\right)^2$

    a. $4x-6\sqrt{2x}+9$ **b.** $4x-9$ **c.** $2x-3\sqrt{2x}-9$ **d.** $2x-6\sqrt{2x}+9$

Chapter 7 Test Form F *cont'd*

13. $\sqrt{3}\left(\sqrt{6}-\sqrt{2}\right)$

     a. $2\sqrt{3}-\sqrt{2}$ **b.** $3\sqrt{2}-\sqrt{6}$ **c.** $2\sqrt{3}$ **d.** $9\sqrt{2}-6$

14. $\left(2\sqrt{x}+7\right)\left(\sqrt{x}-6\right)$

     a. $2x+19\sqrt{x}-42$ **b.** $2x+5\sqrt{x}-42$

     c. $2x-5\sqrt{x}-42$ **d.** $2x+\sqrt{x}-42$

Solve.

15. $\sqrt{x-4}+2=\sqrt{2x-1}$

     a. 5, 11   **b.** 5, 13   **c.** 13, 15   **d.** Ø

16. $\sqrt[3]{3x-5}-2=0$

     a. $\dfrac{13}{3}$ **b.** $\dfrac{7}{3}$ **c.** 1   **d.** Ø

17. $x=\sqrt{7x-10}$

     a. 2, 5   **b.** 3, 5   **c.** 0, 5   **d.** Ø

Perform the indicated operation and simplify. Write the result in the form $a+bi$.

18. $\sqrt{-48}$

     a. $6i\sqrt{3}$ **b.** $3i\sqrt{2}$ **c.** $4i\sqrt{3}$ **d.** $-2\sqrt{12}$

19. $\left(3+2i\right)-\left(7-12i\right)+\left(-9-4i\right)$

     a. $-13+10i$ **b.** $1-14i$ **c.** $-108-48i$ **d.** $13-10i$

20. $2i\left(4-3i\right)$

     a. $2i$ **b.** $8-6i$ **c.** $-6+8i$ **d.** $6+8i$

Chapter 7 Test Form F *cont'd*

21. $\dfrac{3-2i}{3i}$

    a. $\dfrac{2}{3}-i$ **b.** $-\dfrac{2}{3}-i$ **c.** $-\dfrac{2}{3}+i$ **d.** $\dfrac{2}{3}+i$

22. $\left(7-5i\right)^{2}$

    a. $49+25i^{2}$ **b.** $24-70i$ **c.** $24+7i$ **d.** 74

23. $\dfrac{3-6i}{2+i}$

    a. $12-3i$ **b.** $\dfrac{12}{5}-3i$ **c.** $-3i$ **d.** $\dfrac{12}{5}-5i$

24. Find the distance between the two points (3, 6) and (−4, 6).

    a. 62 **b.** $6\sqrt{10}$ **c.** 7 **d.** $\sqrt{37}$

25. Find the midpoint between the two points (−5, 6) and (−13, 10)

    a. (−18, 16)   **b.** (−9, 8)   **c.** (−4, 2)   **d.** (−8, 4)